Claims

[c1]   1.A wireless Internet accelerator comprising:

a client program running on a mobile device;

a client agent running on the mobile device, the client agent coupled to the client program by multiple concurrent Transport-Control-Protocol (TCP) connections;

a server proxy not on the mobile device, coupled to the client agent on the mobile device by a radio link, and coupled to Internet servers by an Internet connection; and

a collective TCP pipeline, using the radio link to exchange packets between the client agent and the server proxy, for exchanging packets from the multiple concurrent TCP connections from the client program using a collective connection that is a single TCP connection between the client agent and the server proxy,

whereby multiple concurrent TCP connections from the client program are combined by the client agent for transmission over the radio link using the collective connection.

[c2]   2.The wireless Internet accelerator of claim 1 further comprising:

a collective TCP controller, receiving packet loss statistics from a plurality of server proxies, for generating TCP parameters that are sent to the plurality of server proxies to adjust TCP parameters for the collective TCP pipeline,

whereby packet loss statistics for many connections are collected and TCP parameters set for radio links.

[c3]   3.The wireless Internet accelerator of claim 2 wherein the collective TCP controller aggregates the packet loss statistics for several connections to different Internet servers by the mobile device;

the collective TCP controller adjusting the TCP parameters based on aggregate packet loss statistics for connections by the mobile device to different Internet servers,

whereby TCP parameters are set based on collective packet loss statistics.

[c4]

4.The wireless Internet accelerator of claim 3 wherein the collective TCP

controller further comprises:

a threshold comparator, for comparing a threshold to an aggregate packet loss collected from the several connections to different Internet servers by the mobile device; and

a parameter calculator, coupled to the threshold comparator, for adjusting the TCP parameters to reduce congestion losses at an Internet router when the aggregate packet loss exceeds the threshold, but for adjusting the TCP parameters to reduce radio losses on the radio link when the aggregate packet loss is below the threshold,

whereby the TCP parameters are adjusted to compensate for radio losses when the aggregate packet loss is below the threshold, but to compensate for router congestion losses when the aggregate packet loss is above the threshold.

[c5]   5.The wireless Internet accelerator of claim 1 wherein the collective connection over the radio link is a persistent connection that persists for a longer period of time than each of the multiple concurrent TCP connections.

[c6]   6.The wireless Internet accelerator of claim 5 wherein the client program is a web browser and the multiple concurrent TCP connections comprise four TCP connections that are open concurrently.

[c7]   7.The wireless Internet accelerator of claim 1 further comprising:

an email client running on the mobile device;

an email agent, the email agent coupled to the email client by multiple sequential requests for email messages;

an email proxy not on the mobile device, coupled to the email agent on the mobile device by the radio link, and coupled to email servers by an Internet connection; and

a collective email pipeline, using the radio link to exchange email messages between the email agent and the email proxy, for exchanging email messages from the multiple sequential requests from the email client using a collective email connection that transfers multiple email messages in parallel between the email agent and the email proxy,

whereby email messages are combined for transmission over the radio link.

[c8]   8.The wireless Internet accelerator of claim 7 wherein multiple email messages
           are transmitted from the email proxy to the email agent over the radio link
           during a single round-trip-time.

[c9]   9.The wireless Internet accelerator of claim 1 wherein the mobile device is a
           web-enabled cell phone or a personal digital assistant (PDA) or a mobile
           Internet device.

[c10]   10.A collective connection controller comprising:
           a plurality of wireless accelerator means, each coupled to a server, for sending
           and receiving packets from a mobile device connected over a wireless link;
           packet-data collector means for receiving packet statistics from the plurality of
           accelerator means;
           table means for storing the packet statistics from the packet-data collector
           means;
           network settings calculation means, coupled to read the packet statistics from
           the table means, for determining a wireless-loss condition when network
           conditions are adversely affected by packet losses over the wireless link, and for
           determining a congestion-loss condition when network conditions are adversely
           affected by packet losses due to congestion at an intermediate router, and for
           adjusting network conditions to compensate for the packet losses; and
           network setting means, responsive to the network settings calculation means,
           for sending network settings adjusted by the network settings calculation
           means based on the congestion-loss or wireless-loss condition, the network
           setting means sending the network settings to the plurality of wireless
           accelerator means,
           whereby network settings are adjusted based on packet statistics collected and
           are adjusted based on a determination of the congestion-loss or wireless-loss
           condition.

[c11]
           11.The collective connection controller of claim 10 wherein the packet statistics
           from the plurality of accelerator means include a packet loss indicator for a
           connection;
           wherein the table means stores a counter for connections with lost packets for

each client—server pair.

[c12] 12.The collective connection controller of claim 11 wherein the table means stores a source address, a destination address, and a packet loss indicator for each cluster of connections between a client and a server.

[c13] 13.The collective connection controller of claim 12 wherein each wireless accelerator means comprises a wireless acceleration card coupled to a server at a remote web site, or coupled to a server or gateway at a wireless carrier data center.

[c14] 14.The collective connection controller of claim 11 wherein each wireless accelerator means comprises server proxy means for sending packets from a server over the wireless link to a client agent on the mobile device; wherein the client agent includes connection combining means for combining several connections from a client program on the mobile device into a single connection between the client agent and the server proxy means; whereby connections are combined for transmission over the wireless link.

[c15] 15.The collective connection controller of claim 14 further comprising: base station means, coupled between the mobile device and the plurality of wireless accelerator means, for receiving packets from the wireless link from the mobile device and for transmitting packets over a wired network to one of the plurality of wireless accelerator means.

[c16] 16.The collective connection controller of claim 14 wherein the several connections from the client program comprise Transport—Control—Protocol (TCP) connections and wherein the network settings include TCP parameters.

[c17] 17.A method for adjusting network settings comprising: collecting packet loss counts from a plurality of wireless accelerators; updating connection records in a table using the packet loss counts collected; scanning the table for connection records for connections in a cluster of connections to a mobile device; counting a number of connections in the cluster of connections with packet losses to get an aggregate loss count;

comparing the aggregate loss count for the cluster to a threshold value;

when the aggregate loss count meets the threshold value, signaling a

congestion cause for the packet losses;

when the aggregate loss count are below the threshold value but more than

zero, signaling a radio cause for the packet losses;

adjusting network settings for connections in the cluster to radio-optimized

settings when the radio cause is signaled; and

adjusting network settings for connections in the cluster to congestion-

optimized settings when the congestion cause is signaled,

whereby packet loss information is collected from wireless accelerators and

used to adjust network settings for connections in a cluster.

[c18]   18. The method of claim 17 wherein adjusting the network settings comprises

adjusting a window size and a time-out when the congestion cause is signaled,

but resetting the window size and the time-out to standard values when the

radio cause is signaled.

[c19]   19. The method of claim 18 wherein adjusting the network settings comprises

sending Transport-Control-Protocol (TCP) parameters to the plurality of

wireless accelerators.

[c20]   20. The method of claim 17 wherein collecting packet loss counts further

comprises collecting endpoint identifiers that include an identifier for the

mobile device;

wherein updating connection records comprises searching the table for or

storing the endpoint identifiers in the connection record.